***PEOPLE: International Journal of Social Sciences***
***ISSN 2454-5899***

*Rosales & Sulaiman, 2016*

*Volume 2 Issue 1, pp. 214-227*

*Year of Publication: 2016*

*DOI- http://dx.doi.org/10.20319/pijss.2016.s21.214227*

*This paper can be cited as: Rosales, J. J. & Sulaiman, F., (2016). Students' Personal Interest Towards Project – Based Learning. PEOPLE: International Journal of Social Sciences, 2(1), 214-227.*



# STUDENTS' PERSONAL INTEREST TOWARDS PROJECT – BASED LEARNING

**Jeffry Juan Rosales JR**
*Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia*
*previousguardian@hotmail.com*

**Fauziah Sulaiman**
*Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia*
*fauziahs@ums.edu.my*
*fauziahsulaiman6@gmail.com*

## Abstract

*This study was attempted by the researcher to examine students' personal interest with the implementation of Project-Based Learning (PBL) – egg drop project towards learning physics in three (3) different perspectives which were overall students, gender (i.e., male and female students) and location (i.e., urban and rural students). Students have done egg drop project to have better understanding towards physics concepts (i.e., momentum, impulse and impulsive force).This research was taken place in one selected school at Tuaran (i.e., 20 urban students) and Kota Marudu (i.e., 18 rural students) Districts and was carried out by thirty-eight (38) Form Four students (i.e., 17 male and 21 female students) for both schools in total. Quantitative data were collected via The Colorado Learning Attitude about Science Survey (CLASS) – personal interest category before and after PBL. Gathered data were analysed by using Statistical*

*Package for Social Science Version 20.0 for windows (SPSS) to compare students' pre-survey and post-survey responses by using Wilcoxon Signed Ranks Tests and Paired Samples-t-test. Wilcoxon Signed Ranks Tests results showed that students' personal interest in each perspective have a statistically significant difference after PBL except rural students' personal interest have no significant difference after PBL. Paired samples-t-test results showed that students' personal interest in each perspective have a statistically significant difference after PBL. Through PBL, students' personal interest have increased and able to change students' perception towards learning physics.*

**Keywords**

Project-Based Learning, Physics Education, Egg Drop Project, Personal Interest

## 1. Introduction

Physics' popularity is not so high among secondary school's students (Holubova, 2008). Male students show higher interest in physics than female students (Trumper, 2006; Williams, Stanisstreet, Spall, Boyes and Dickson, 2003; Veloo, Rahimah and Rozalina, 2015). Female students prefer to learn chemistry than physics because feel discouraged due to male students do better in physics (Cervini, 2014). Meanwhile, urban students have higher personal interest towards physics in comparison to rural students (Fatin, Salleh, Bilal and Salmiza, 2012). In general, rural students are left behind in terms of academic achievements as well as lower educational aspirations (Salmiza, 2014). In Malaysia, physics subject taught at the beginning of Form 4 in secondary school. This is to get along with the Malaysian Education Philosophy to generate a knowledgeable community in the country (Norihan, Hamzah and Udin, 2011). In Malaysia, students who pursue physics in secondary school level are still far behind where most schools provide approximately 40% science students than arts students (Salmiza, 2014). To change students' perception about physics, new pedagogical strategies need to be adopted beyond the traditional approach to improve the learning outcomes. Because of this, researcher comes forward by introducing Project Based Learning (PBL) to improve students' personal interest towards physics.

## 2. Literature Review

Many students who enrolled in physics related course think and say, physics is difficult to learn and understand (Angell, Guttersrud, Henriksen and Isnes, 2004). This problem leads to a point where students feel to learn physics is beyond their ability and capabilities to comprehend (Kovanen, 2011). The obvious factor makes physics difficult on the students' view are physics irrelevant to learn with the connection of everyday life and the more students learn about physics the more boring they will get (Erinosho, 2013). In Malaysia, one of the major reasons to contribute in lacking of students enrollment in the science stream due to physics is difficult (Salmiza, 2014).

Traditional approach to teach physics has been used for a long time not just in secondary school level but as well as university level that often leads students hard to connect what they have learn in class with the real life situations (Wang, 2015). Traditional approach involves teacher - centred learning method where students just sit; look at the teacher explanation and solves associated problems in front. At the same time, students just passively absorb information what they hear and see (Liu, 2014). In Malaysia, teachers favour to use traditional approach generally as a method in their teaching at school since Malaysian education system is too examination – based oriented and over emphasis on rote learning (Chuo, 2007).

Teachers know that traditional approach does not effective to teach physics and constructivism teaching method has been adopted (Jones and Araje, 2002). Constructivism is based on the nature of knowing that learning is constructed from experience (Tam, 1999). PBL is adopting constructivist learning theory where students construct their own knowledge based on experience through actual projects (Holubova, 2008). PBL is an instructional designed of permitting learners to engage content knowledge on their own and to exhibit their new understanding by using many forms of presentation modes (New York City Department of Education, 2009). During the past decade, PBL gradually developed into a formal teaching strategy which PBL triggers student's interest with good designed projects (Intel Research program, 2007). In Malaysia, PBL serves students to explore their interests in the framework of school curriculum (Azura, Farizah and Suriana, 2012). Moreover, students give a positive feedback about the implementation of PBL in learning physics where students' interest increase after PBL (Liu, 2014).

Egg drop project helps students to enhance their understanding towards physics concepts especially momentum and impulse concept (Lost Angeles Unified School District, USA, 2012; Yusfi 2014). In addition, through egg drop project, students' interest to learn physics increases which students free to apply their own skills and knowledge. Moreover, hands-on projects such as egg drop project helps students to have better understanding towards physics and increase their interest (Sridhara, 2013).

Interest is one of the main factors to influence students' learning behaviour and engage students' tendency to participate for future involvement in their learning process (Subramaniam, 2009). From the four - phase model of interest development, a person's interest can be divided into four phase; triggered situational interest (phase 1), maintained situational interest (phase 2), emerging individual interest (phase 3) and well-developed individual interest (phase 4) which each phase of interest varied with the amount of affect, knowledge and value (Hidi and Renninger, 2006). Situational interest can be triggered by certain appealing stimuli in the environment that have immediate affective reaction towards people that may or may not last longer (Dohn, Madsen and Malte, 2009). In addition, situational interest and individual interest interact and influence to each other's development (Subramaniam, 2009). Through repeated experiences of situational interest over time have tremendous effects on students' individual interest towards particular subject (Dohn et al., 2009). Moreover, individual interest develops slowly and can be maintained for a long time period and relatively stable. According to (Ainley, Hidi and Berndorff, 2002), individual interest involved positive affect, persistence and tendency to increase learning happened in individual psychological state.

## 3. Research Objectives

By introducing Project Based Learning (PBL) in learning physics, students expose with real problems that involved in physics not just theoretically but see the problems right in front of them (Muzzarelli, 2007). After that, students make it work by investigating and try to solve the problems (Liu, 2014). The main objectives of this study were:

- To compare students' personal interest before and after the implementation of PBL
- To compare male and female students' personal interest before and after the implementation of PBL

- To compare urban and rural students' personal interest before and after the implementation of PBL

## 4. Research Methodology

This study was using a quantitative methodology and designs with pre-survey - post-survey to experimental group which designed without a control group (Encyclopedia of Research Design, 2010). Sample collected from two schools situated in Tuaran District which represented an urban area (School A) and Kota Marudu District which represented a rural area (School B). There were thirty – eight (38) Form Four (4) science students were involved in this study who took physics. As students were the respondents for this research, data could be extracted from two different places to measure the effectiveness of the implementation of PBL to improve students' personal interest (PI) towards physics. Researcher used the same methodology for both schools for this study. Table 1 showed the overall total of sample in both schools:

**Table 1:** *Students' Distribution from Both Schools*

| **School** | **Gender** | | **Total** |
|---|---|---|---|
| | **Male** | **Female** | |
| ***A*** | 8 | 12 | 20 |
| ***B*** | 9 | 9 | 18 |

### 4.1 Teacher's role

Teacher plays an important role during the implementation of PBL. Teacher acts as a facilitator and provide hands-on activities that focuses on students' learning towards issues of problems and topic that not included in the textbook (Holubova, 2008). In addition, teacher need to choose projects that can influence students' engagement to develop their interest towards physics as the learning more meaningful and students can relate physics concepts into real life situations within the physics curriculum (Subramaniam, 2009). In addition, teacher's role needs to inspire and help students to understand the physics concept with several of teaching strategies.

### 4.2 Survey Questionnaire

Students' personal interest towards physics can be measured using The Colorado Learning Attitude about Science Survey (CLASS) – personal interest category (Adams, Perkins,

Podolefsky, Dubson, Finkelstein and Wieman, 2006). Six (6) statements of CLASS - personal interest category are listed below:

- I think about the physics I experience in everyday life.
- I am not satisfied until I understand why something works the way it does.
- I study physics to learn knowledge that will be useful in my life outside of school.
- I enjoy solving physics problems.
- Learning physics changes my ideas about how the world works.
- Reasoning skills used to understand physics can be helpful to me in my everyday life.

Each item statement has a five-level Likert Scale degree of agreement which is: 5 – Strongly Agree; 4 – Agree; 3 – Neutral; 2 – Disagree; and 1 – Strongly Disagree (Adams et al., 2006). All six (6) statements passed the reliability and validity tests conducted by the University of Colorado Physics Education Research Group (Mistades, Reyes and Scheiter, 2011). Before PBL intervention, pilot test was conducted and the Cronbach's Alpha ($\alpha$) coefficient value for CLASS – personal interest category was $\alpha = 0.941$. Result revealed that CLASS – personal interest category instruments was reliable to be used in the data collection. Students were asked to rate their degree of agreement to all six statements in the questionnaires. Students conducted the pre-survey and post-survey before and after the intervention of PBL by using the same exact questionnaires.

### 4.3 Implementation of Project-Based Learning (Egg Drop Project)

Students worked in a group project of three or four students. Students relate the physics concepts within the physics curriculum content; momentum, impulsive and impulsive force to build an egg protector by using three fundamental materials; toothpicks, superglues and a raw egg provided by the facilitator. Each group was given two weeks to design and build a concrete egg protector, discuss project-related issues among group members and the facilitator. After two weeks, egg drop launching session was conducted from the two-level of building block. Each group need to make sure the raw egg not break after landed on the ground.

## 5. Results and Discussion

According to Frost (2015), parametric analyses can be performed well with continuous data which obtained from small samples greater than twenty (20). In addition, it is best to employ

the 'paired- samples t-test' if the data is in normal distribution, and the 'Wilcoxon Signed Rank test' if the distribution is not normal and in a small number of the sample to investigate differences between groups (Coakes, 2005). In this study, Wilcoxon signed ranks test was used to analyse the median data and paired sample t-test to analyse the mean data (Frost, 2015). Statistical Package for Social Science Version 20.0 for windows (SPSS) was used to analyze the data.

### 5.1 Students' Personal Interest towards Physics

Wilcoxon signed-ranks test results in Table 2 showed that overall students for both schools in total have a statistically significant difference between the median value level Likert scale of agreement of post-survey and pre-survey ($Z$ = -4.45, $p$ = 0.00*). The median value for post-survey was 4.17 and pre-survey was 3.67 respectively.

Paired samples *t*-test results in Table 2 revealed that overall students for both schools in total have a statistically significant difference between the mean value level Likert scale degree of agreement of post-survey (M = 4.09, SD = 0.45) and pre-survey (M = 3.63, SD = 0.44) that the students have, $t(37) = 6.14$, $p = 0.00^*$, $p \leq 0.05$.

**Table 2:** *Results of Overall Students' Personal Interest for Both Schools in Total*

| **Likert Scale Value** | **Wilcoxon Signed Ranks Test** | | **Paired Samples t-test** | |
|---|---|---|---|---|
| | **Pre-survey** | **Post-Survey** | **Pre-survey** | **Post-survey** |
| **Mean** | | | 3.63 | 4.09 |
| **SD** | | | 0.44 | 0.45 |
| **Median** | 3.67 | 4.17 | | |
| **Z / t value** | Z = -4.45 | | t(37) = 6.14 | |
| **p – value** | 0.00* | | 0.00* | |

**is significant at $p \leq 0.05$*

These results show that PBL - egg drop project gives positive effect on students' personal interest towards learning physics. These findings are similar to what has been reported by Liu, (2014), which stated that through PBL; students' interest towards physics can be increased. When students have an interest with the intervention of PBL, learning physics is meaningful where students can discover new scientific issues and construct new knowledge from their experience (Kubiatko and Vaculova, 2011). Contrary, these results are not similar with what

have been reported by (Muzzarelli, 2007) which stated that after the implementation of PBL there is negative effect towards students' interest. Similar finding has been reported by (Sridhara, 2013) and (Kasunic et al., 2012), through egg drop project, students' interest towards physics also increased.

According to Yusfi (2014), in egg drop project activities, students designed a landing pad made from papers and masking tape. When an egg dropped from a certain height, the landing pad prevented the egg from broken. In addition, according Sridhara (2013), students built an egg container to protect the egg from broken by using balsa wood sticks, glue and raw egg during egg drop project activities. Then, students built a parachute made from plastic bag to be attached with the unit and dropped from a certain height and place on a target zone. In this study, students built an egg protector made from toothpicks, superglue and raw egg. Then, students dropped the egg protector from two-level of building block without a parachute and students have to make sure the raw egg is not broken. These three different egg drop projects share the same outcomes to deepen students understanding towards physics concepts involved.

**5.2 Gender' Personal Interest towards Physics**

Wilcoxon signed-ranks test results showed that male students for both schools in total have a statistically significant difference between the median value level Likert scale degree of post-survey and pre-survey ($Z$ = -3.52, $p$ = 0.00*). The median value for post-survey was 4.17 and pre-survey was 3.67. Meanwhile, female students for both schools in total also have a statistically significant difference between the median value level Likert scale degree of agreement for post-survey and pre-survey ($Z$ = -2.59), $p$ = 0.01*). Meanwhile, median value for post-survey was 4.00 and pre-survey was 3.67.

Paired samples *t*-test results revealed that male students for both schools in total have a statistically significant difference between the mean value level Likert scale degree of agreement of post-survey (M = 4.25, SD = 0.32) and pre-survey (M = 3.63, SD = 0.37), $t(16) = 6.65$, $p$ = 0.00*, $p \leq 0.05$. Meanwhile, female students for both schools in total have a statistically significant difference between the mean value level Likert scale degree of agreement of post-survey (M = 3.96, SD = 0.50) and pre-survey (M = 3.63, SD = 0.49), $t(20) = 3.11$, $p$ = 0.01*, $p \leq$ 0.05. Results on both tests towards genders for both schools in total were represented in Table 3 below:

**Table 3:** *Results on Gender's Personal Interest for Both Schools in Total*

| Gender | Likert Scale Value | Wilcoxon Signed Ranks Test | | Paired Samples t-test | |
|---|---|---|---|---|---|
| | | Pre-survey | Post-survey | Pre-survey | Post-survey |
| Male (N=17) | Mean | | | 3.63 | 4.25 |
| | SD | | | 0.37 | 0.32 |
| | Median | 3.67 | 4.17 | | |
| | Z/ t value | Z = -3.52 | | t(16) = 6.65 | |
| | p – value | 0.00* | | 0.00* | |
| Female *(N=21)* | Mean | | | 3.63 | 3.96 |
| | SD | | | 0.49 | 0.50 |
| | Median | 3.67 | 4.00 | | |
| | Z/ t value | Z = -2.59 | | t(20) = 3.11 | |
| | p – value | 0.01* | | 0.01* | |

**is significant at $p \leq 0.05$*

These results show that male students have higher increase in terms of their personal interest after the implementation of Project-Based Learning (egg drop project) in comparison with the female students. Similar findings reported by (Trumper, 2006) and (Williams et al., 2003) where male students have showed higher interest in Physics compared to female students. Similar findings also reported by Veloo et al. (2015), male students' interest towards physics are higher than female students.

**5.3 Urban and Rural Students' Personal Interest towards Physics**

Wilcoxon signed-rank test results showed that urban students (School A) have a statistically significant difference between the median value level Likert scale degree of agreement for post-survey and pre-survey ($Z$ = -3.93, $p$ = 0.00*). Meanwhile, median value for post-survey was 4.08 and pre-survey was 3.33. Contrary for rural students (School B) showed no significant different between median value level Likert scale degree of agreement for post-survey and pre-survey ($Z$ =-1.92), $p$ = 0.06). The median value for post-survey was 4.17 and pre-survey was 4.00.

Paired samples t-test results revealed that urban students have a statistically significant difference between the mean value level Likert scale degree of agreement of post-survey (M =

4.07, SD = 0.52) and pre-survey (M = 3.36, SD = 0.39) that the students have, $t$ (19) = 7.77, $p$ = 0.00*, $p \leq 0.05$. Meanwhile, rural students (School B) have a statistically significant difference between the mean value level Likert scale degree of agreement of post-survey (M = 4.12, SD = 0.37) and pre-survey (M = 3.93, SD = 0.26) that the students have, $t$(17) = 2.42, $p$ = 0.04*, $p \leq$ 0.05. Results on both tests were represented in Table 4 below:

**Table 4:** *Results of Urban and Rural Students' Personal Interest*

| **Students** | **Likert Scale Value** | **Wilcoxon Signed Ranks Test** | | **Paired Samples t-test** | |
|---|---|---|---|---|---|
| | | **Pre-survey** | **Post-survey** | **Pre-survey** | **Post-survey** |
| **Urban (N=20) School A** | **Mean** | | | 3.36 | 4.07 |
| | **SD** | | | 0.39 | 0.52 |
| | **Median** | 3.33 | 4.08 | | |
| | **Z/ t value** | Z = -3.93 | | t(19) = 7.77 | |
| | **p – value** | 0.00* | | 0.00* | |
| **Rural (N=18) School B** | **Mean** | | | 3.93 | 4.12 |
| | **SD** | | | 0.26 | 0.37 |
| | **Median** | 4.00 | 4.17 | | |
| | **Z/ t value** | Z = -1.92 | | t(17) = 2.42 | |
| | **p – value** | 0.06 | | 0.04* | |

**is significant at $p \leq 0.05$*

These findings show that urban students have higher personal interest towards physics compare to rural students. These findings also consistent with previous results which are in general rural students are left behind in terms of academic achievements as well as lower educational aspirations (Salmiza, 2014). In addition these findings are in line with what reported by (Fatin et al., 2012) which stated that urban students have higher personal interest in physics compare to rural students. Contrary these findings not in line with what reported by (Seth, Abdullah and Ali, 2007) which stated that rural students have higher interest in physics as compared to urban students.

## 6. Conclusion

The Colorado Learning Attitude about Science Survey (CLASS) – personal interest category results have reflected a strong agreement that implementation of Project-Based Learning (PBL) can increase students' personal interest towards physics in terms of genders and urban students except rural students' personal interest have no significant difference after PBL. Rural students need to be exposed with various kinds of learning intervention to increase their personal interest towards physics due to lower educational aspirations in their academic achievements. Through PBL, students have a clear understanding with physics concepts they have learned in class and indirectly can change their perception towards physics into straighter forward and enjoy learning.

## References

Adams, W., Perkins, K., Podolefsky, N., Dubson, M., Finkelstein, N., & Wieman, C. (2006). New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey. *Physical Review Special Topics – Physics Education Research.* 2(1), 1 – 14. Retrived from http://doi.org/10.1103/PhysRevSTPER.2.010101

Ainley, M., Hidi, S., & Berndorff, D. (2002). Interest, learning, and the psychological processes that mediate their relationship. *Journal of Educational Psychology*, *94*(3), 545–561. http://doi.org/10.1037/0022-0663.94.3.545

Amy P. Muzzarelli, *The Effect of Implementing Project-based Education in High School Physics: File Folder Bridge Engineering: Digital Commons, Michigan Technological University, 2007.*

Angell C, Guttersrud Ø, Henriksen E K and Isnes A 2004 Physics: frightful, but fun. Pupils'and teachers' view of physics and physicsteachingSci. Educ.88683–706

Azura Omar, Nor Farizah Taib & Ida Suriana Basri (2012). Project-Based Learning : English Carnival In Universiti Kuala Lumpur-Malaysia France Universiti Kuala Lumpur-Malaysia France Institute, English, T., & Vol, T. *XLI*(August), 27–41.

Cervini, Erica (December 14, 2014) Physics is too hard for women, according to female physics students Retrieved from http://www.theage.com.au/national/education/physics-is-too-hard-for-women-according-to-female-physics-students-20141208-122p2n.html

Chuo, M. Hong (2007). Breaking Away From Exam-oriented Mentality Through Presentations in EST Lessons, Seminar Penyelidikan Pendidikan Institut Perguruan Batu Lintang Tahun 2007 1. *Seminar*, 1–10.

Dohn, N. B., Madsen, P. T., & Malte, H. (2009). The situational interest of undergraduate students in zoophysiology. *Advances in Physiology Education*, *33*(3), 196–201. http://doi.org/10.1152/advan.00038.2009

Encyclopedia of Research Design. 2010. Pretest-Posttest Design. *In Encyclopedia of Research Design*. Sage Research Methods, pp.1087 - 1092

Erinosho, S. Y. (2013). How Do Students Perceive the Difficulty of Physics in Secondary School ? An Exploratory Study in Nigeria, *3*(3), 1510–1515. http://doi.org/10.1145/2212776.2223799

Fatin Aliah Phang, Mohd Salleh Abu, Mohammad Bilal Ali, & Salmiza Salleh. (2012). Faktor Penyumbang Kepada Kemerosotan Penyertaan Pelajar Dalam Aliran Sains: Satu Analisis Sorotan Tesis. *Seminar Kebangsaan Majlis Dekan Pendidikan IPTA*, MEDC2012. 1-17. http://doi.org/10.14221/ajte.2011v36n3.2

Frost, Jim (19 February 2015) Choosing Between a Nonparametric Test and a Parametric Test. Retrieved from http://blog.minitab.com/blog/adventures-in-statistics/choosing-between-a-nonparametric-test-and-a-parametric-test

Hidi, S., & Renninger, K. A. (2006). The Four-Phase Model of Interest Development. *Educational Psychologist*, *41*(2), 111–127 http://doi.org/10.1207/s15326985ep4102_4

Holubova, R. (2008). Effective teaching methods — Project-based learning in physics. *US-China Education Review*, *5*(12), 27–36.

Intel Research Program (2007). Designing Effective Projects : Characteristics of Projects Benefits of Project-Based Learning Overview of Project-Based Learning Benefits of Project-Based Learning. *Education*, 1–4.

Jones, M. G., & Brader-Araje, L. (2002). The impact of constructivism on education: Language, discourse, and meaning. *American Communication Journal*, *5*(3).

Kasunic, K. J., Bagnell, M., D'Archangel, J., Dillard, A. W., Douglass, K. M., Mills, M. S., … Webb, B. (2012). Research-centric project-based learning of optomechanical design, 84810A http://doi.org/10.1117/12.928383

Kovanen, A. (2011). Where are we after 30 years of physics education research ?, (2010).

Kubiatko, M., & Vaculová, I. (2011). Project-based learning: characteristic and the experiences with application in the science subjects. *Energy Educ Sci Technol Part B*, *3*(1), 65–74. Retrieved from http://kubiatko.eu/clanky_pdf/project_based_learning_

Liu, S. (2014). Implementing Project-Based Learning in Physics and Statics Courses. *121st ASEE Annual Conference & Exposion*, (June 15-18, 2014).

Lost Angeles Unified School District, USA, (2012) Physics:Idea, B., & Generation, N. (n.d.). Intro to Momentum Culminating Activity – Car Safety Engineering.

Mistades.V., Reyes. R.D & Scheiter. (2011). Transformative Learning : Shifts in Students ' Attitudes toward Physics Measured with the Colorado Learning Attitudes about Science Survey, *1*(7), 45–52.

New York City Department of Education. (2009). Project-Based Learning: Inspiring Middle School Students to Engage in Deep and Active Learning. *Learning*.

Norihan, I. S., Hamzah, R., & Udin, A. (2011). Kemantapan Penerapan Falsafah Pendidikan Kebangsaan Teras Kemenjadian Guru Pendidikan Teknik Dan Vokasional. *Journal of Edupres*, *1*(September), 357–363. Retrieved from http://eprints.utm.my/17085/1/JOE-1-2011-043.pdf

Salmiza. Saleh. (2014). School of Educational Studies, Universiti Sains Malaysia, Malaysia. Malaysian students ' motivation towards Physics learning, European Journal of Science and Mathematics Education *Vol.2,No.4*, 223–232.

Sridhara, B. S. (2013). Course-related undergraduate projects for dynamics. *ASEE Annual Conference and Exposition, Conference Proceedings*. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84884338951&partnerID=40&md5=1d75365d4d3521bede84853f079c4c3d

Subramaniam, P. R. (2009). Motivational Effects of Interest on Student Engagement and Learning in Physical Education : A Review. *Int J Phys Education*, *46*(2), 11–20.

Sulaiman, Seth., Abdullah, F. A. P., & Ali, M. (2007). Kemahiran Metakognitif Dalam Kalangan Pelajar Sekolah Menengah di Negeri Johor Dalam Menyelesaikan Masalah Fizik. *Laporan Teknikal*, *Vot 75161*, 1–59.

Tam, Maureen (1999). Constructivism : Implications for Teaching and Learning. Journal of Education. Teaching Matters at Lingnan, Teaching Learning Centre, 22 November 1999

Trumper, R. (2006). Factors affecting junior high school students' interest in physics. *Journal of Science Education and Technology*, *15*(1), 47–58. http://doi.org/10.1007/s10956-006-03556http://dx.doi.org/10.1007/s10956-006-0355-6

Veloo, A., Nor, R., & Khalid, R. (2015). Attitude towards physics and additional mathematics achievement towards physics achievement. *International Education Studies*, *8*(3), 35–43. http://doi.org/10.5539/ies.v8n3p35 http://dx.doi.org/10.5539/ies.v8n3p35

Wang, L. (2005). Using new strategies to improve teaching and learning in a Fundamental Physics course, (July).

Williams, C., Stanisstreet, M., Spall, K., Boyes, E., & Dickson, D. (2003). Why aren't secondary students interested in physics? *Physics Education*, *38*(4), 324–329. http://doi.org/10.1088/0031-9120/38/4/306 http://dx.doi.org/10.1088/0031-9120/38/4/306

Yusfi . Md. Yusop (2014). International Journal of Aerospace Aviation & Astronautics Volume 1, Edition III, January 2014*Igarss 2014*, (1), page 15 - 23